

REMARKS

Claims 60-71 and 75-80 are presently pending in this application. Claim 59 has been cancelled without prejudice, and claims 60-64, 67, 68, 75 and 78 have been amended in this response.

In the Office Action mailed July 12, 2006, claims 59-71 and 75-80 were rejected. More specifically, the status of the application in light of this Office Action is as follows:

- (A) The disclosure was objected to because of an informality;
- (B) Claims 59-71 and 75-80 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,018,192 to Root et al. ("Root"); and
- (C) Claim 71 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Root.

A. **Response to the Disclosure Objection**

The disclosure was objected to because (a) the Cross-Reference To Related Applications section should be updated, and (b) the Examiner believed that characters are missing from the first line on page 6 of the specification. The Cross-Reference section has been updated as requested by the Examiner. The first line on page 6 recites, "than the projected area PA and this increased surface area can enhance the." "PA" refers to the projected area and is illustrated in Figure 2B. Accordingly, no characters are missing from the first line on page 6. Therefore, the objection to the disclosure should be withdrawn.

B. **Response to the Section 102(b) Rejection**

Claims 59-71 and 75-80 were rejected under 35 U.S.C. § 102(b) as being anticipated by Root. Claim 59 has been cancelled in this response and therefore the rejection of this claim is now moot. As set forth in detail below, Root fails to disclose or suggest all the features of claims 60-71 and 75-80.

1. Claim 63 is Directed to a Method of Making a Microelectronic Device Including Coupling an External Surface of a Sealed Heat Transport System to a Surface of a Microelectronic Substrate

Claim 63 is directed to a method of making a microelectronic device including forming active devices at least proximate to a first surface of a microelectronic substrate. The microelectronic substrate further includes a second surface facing opposite the first surface. The method further includes removing material from the second surface of the microelectronic substrate to form heat transfer features and coupling an external surface of a sealed heat transport system to the second surface of the substrate. The second surface has a projected area smaller than the surface area of the second surface. The heat transport system includes a sealed cavity and a thermal conductor disposed within the cavity.

2. Root Discloses an Electronic Device Including a Substrate, First and Second Dies Attached to the Substrate, and a Cooling Fluid Flowing Through Bubbler Cavities on the Back Surfaces of the First and Second Dies

Root discloses an electronic device including a substrate, a first die attached to the substrate, and a second die attached to the substrate. The first and second dies have a back surface and a plurality of bubbler cavities at the back surface. The bubbler cavities on the first and second dies are in fluid communication with each other and positioned to receive a cooling fluid that flows through the electronic device. As such, "[t]wo-phase cooling is enabled through the use of bubbler cavities in contact with a cooling fluid." (Root, col. 3, lns. 5-6.)

3. Root Fails to Disclose or Suggest a Method for Making a Microelectronic Device Including Coupling an External Surface of a Sealed Heat Transport System to a Surface of the Microelectronic Substrate

Root fails to disclose or suggest a method of making a microelectronic device including, *inter alia*, "coupling to the second surface of the microelectronic substrate an external surface of a sealed heat transport system having a sealed cavity and a thermal conductor disposed within the cavity," as recited in claim 63. In the Office Action, the Examiner alleged that attaching Root's first or second die to the substrate with a polymeric underfill corresponds to the following feature of claim 63: coupling a sealed heat transport system to the second surface of the substrate. This assertion, however, is incorrect for several reasons. First, claim 63 requires removing material

from the second surface of the substrate to form heat transfer surface features and coupling a sealed heat transport system to the same second surface. In contrast, Root forms bubbler cavities at the back surface of the dies and attaches the active surface to the substrate. Furthermore, claim 63 requires coupling an external surface of the sealed heat transport system to the second surface of the substrate. In contrast, Root's first and second dies are placed within an electronic device such that the cooling fluid flows over the dies and into the bubbler cavities of both dies. Moreover, Root teaches away from claim 63 because the second surface of the substrate is attached to an external surface of the sealed heat transport system in the claimed method, whereas Root states, "[t]wo-phase cooling is enabled through the use of bubbler cavities in contact with a cooling fluid," and two-phase cooling is one purpose of Root's invention. (Root, col. 3, lns. 5-6.) Therefore, Root fails to disclose or suggest coupling an external surface of a sealed heat transport system to the second surface of a microelectronic substrate. Accordingly, the Section 102(b) rejection of claim 63 should be withdrawn.

Claims 60-62 and 75 depend from claim 63. Accordingly, the Section 102(b) rejection of claims 60-62 and 75 should be withdrawn for at least the reasons discussed above with reference to claim 63 and for the additional features of these claims.

4. Claim 64 is Directed to a Method of Making a Microelectronic Device Including Coupling an Enclosure Member to a Surface of a Microelectronic Substrate to Sealably Enclose a Recess

Claim 64 is directed to a method of making a microelectronic device including forming active devices at least proximate to a first surface of a microelectronic substrate, forming at least one recess in a second surface of the microelectronic substrate, and disposing a thermal conductor in the at least one recess. The thermal conductor is not configured to provide electrical communication between the microelectronic substrate and external components. The method further includes coupling an enclosure member to the second surface of the microelectronic substrate to sealably enclose the at least one recess with the thermal conductor positioned and configured to transfer heat from the active devices to a region external to the microelectronic substrate.

5. Root Fails to Disclose or Suggest a Method of Making a Microelectronic Device Including Coupling an Enclosure Member to a Surface of a Microelectronic Substrate to Sealably Enclose a Recess

Root fails to disclose or suggest a method of making a microelectronic device including, *inter alia*, "coupling an enclosure member to the second surface of the microelectronic substrate to sealably enclose the at least one recess," as recited in claim 64. As described above with reference to claim 63, the back surfaces of Root's dies are exposed to the cooling fluid flow so that the cooling fluid can flow into the bubbler cavities. As such, Root does not disclose coupling an enclosure member to the back surface of the first or second die to enclose the bubbler cavities. To the contrary, the bubbler cavities are open and in fluid communication with one another and the interior of the electronic device. Moreover, Root teaches away from claim 64 because an enclosure member is coupled to the second surface to sealably enclose a recess in the claimed method, whereas Root's bubbler cavities are open to enable two-phase cooling, which is one purpose of Root's invention. Therefore, Root fails to disclose or suggest coupling an enclosure member to the second surface of the substrate to sealably enclose a recess. Accordingly, the Section 102(b) rejection of claim 64 should be withdrawn.

Claims 65-67, 76 and 77 depend from claim 64. Accordingly, the Section 102(b) rejection of claims 65-67, 76 and 77 should be withdrawn for at least the reasons discussed above with reference to claim 64 and for the additional features of these claims.

Independent claim 68 includes, *inter alia*, features generally similar to the features in claim 63. Accordingly, the Section 102(b) rejection of claim 68 should be withdrawn for at least the reasons discussed above with reference to claim 63 and for the additional features of claim 68.

Claims 69-71 and 78-80 depend from claim 68. Accordingly, the Section 102(b) rejection of claims 69-71 and 78-80 should be withdrawn for at least the reasons discussed above with reference to claim 68 and for the additional features of these claims.

C. Response to the Section 103(a) Rejection

Claim 71 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Root. Claim 71 depends from claim 68. Accordingly, the Section 103(a) rejection of claim 71 should be

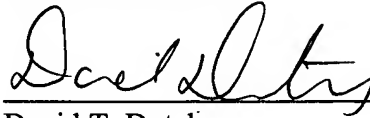
withdrawn for the reasons discussed above with reference to claim 68 and for the additional features of claim 71.

D. Conclusion

In view of the foregoing, the pending claims comply with 35 U.S.C. § 112 and are patentable over the applied art. The applicants accordingly request reconsideration of the application and a Notice of Allowance. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to call the undersigned representative at (206) 359-6465.

Respectfully submitted,

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